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EXAMINER

STAHL, MICHAEL J

ART UNIT

PAPER NUMBER

2874

DATE MAILED: 07/09/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/784,649

Applicant(s)

ISLAM, MOHAMMED N.

Examiner

Mike Stahl

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-224 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 1-19, 21-54, 63-110, 137, 158 and 179 is/are allowed.
- 6) ☒ Claim(s) See Continuation Sheet is/are rejected.
- 7) ☒ Claim(s) See Continuation Sheet is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on ^{23 May 2001}~~14 February 2001~~ is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). ____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4. 6) ☐ Other: _____

Continuation of Disposition of Claims: Claims rejected are 56-59,111,114-117,120,122-124,126,128-130,135,136,198,201-204,209-211,213,215-217 and 222-224.

Continuation of Disposition of Claims: Claims objected to are 20,55-62,112,113,118,119,121,125,127,131-134,138-157,159-178,180-197,199-224.

Information Disclosure Statement

The references submitted 26 April 2001 have been considered. Initialed copies of form PTO-1449 are attached.

Drawings

The originally filed drawings have been replaced with the formal drawings submitted 23 May 2001.

Fig. 6B is objected to because "Recommpressed" should be "Recompressed". Figs. 19 and 21 are objected to because "LAUCHED" should be "LAUNCHED". A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Objections

Claims 20, 55-62, 118, 138-157, 159-178, 180-197, and 199-224 are objected to because of the following informalities. Appropriate corrections are required.

Claim 20 is objected to because it duplicates claim 19. It appears that claim 20 should contain the further limitations presented in claim 40.

Claims 55-62 are objected to because they recite "the mirror of claim X", but they ultimately depend from claim 54 which is directed to an optical regeneration system, not just a mirror.

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Claim 118 is objected to because there is an extraneous period at the start of the claim.

Claims 138-157 are objected to because they recite “the mirror of claim X”, but they ultimately depend from claim 137 which is directed to an optical signal processing system, not just a mirror.

Claims 159-178 and 197 are objected to because they recite “the mirror of claim X”, but they ultimately depend from claim 158 which is directed to an optical signal processing system, not just a mirror.

Claims 180-196 are objected to because they recite “the mirror of claim X”, but they ultimately depend from claim 179 which is directed to an optical signal processing system, not just a mirror.

Claims 199-224 are objected to because they recite “the mirror of claim X”, but they ultimately depend from claim 198 which is directed to an optical signal processing system, not just a mirror.

Claim 56 is additionally objected to because “with” should be “has”.

Claim 60 is additionally objected to because it substantially duplicates claim 55.

Claim 62 is additionally objected to because it ends with more than one period.

Claim 156 is additionally objected to because it duplicates claim 155.

Claim 214 is additionally objected to because “positionally” should be “positioned”.

Given the length of the disclosure, it is likely that not all minor errors have been identified. Applicant's cooperation is requested in correcting any additional errors applicant may find.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 56-59 and 120 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 56-59 are indefinite because they recite “the optical fiber”, but depend from claim 54 which recites two fibers. Claims 56-59 do not make clear whether the first or the second fiber is to have the recited dispersion or nonlinear coefficient.

Claim 120 is indefinite because it recites “the dispersion compensating fiber” but depends from claim 111 which does not mention any dispersion compensating fiber. This could be fixed by changing claim 120 to depend from claim 118 (see for example claim 121).

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 111, 114-117, 122-124, 126, 128-130, and 135-136 are rejected under 35 U.S.C. 102(b) as being anticipated by Lichtman et al. (US 5646759).

Lichtman discloses an NOLM (fig. 1) comprising a first fiber **16** with a first effective nonlinearity; a second fiber **36** coupled to the first fiber and forming a loop with it, the second fiber having a different second effective nonlinearity; a bidirectional amplifier **18** coupled to each of the first and second fibers; and a coupler **12** coupled to the first and second fibers. It is asserted that fibers **16** and **36** have different effective nonlinearities because the first fiber **16** has an effective area of 35 square microns, while fiber **36** (which is believed to be a standard single mode fiber) has an effective area on the order of about 80 square microns as described in the present specification. It is asserted that the nonlinear refractive index of the first fiber is roughly equal to that of the second fiber, so that the difference in effective nonlinearities results primarily from the difference in effective areas of the fibers. The Lichtman device thus satisfies claims 111 and 126.

As to claim 114, the recited limitations merely represent the standard definition of effective nonlinearity. The fibers in the Lichtman device satisfy these limitations. As to claim 115, assuming that the first and second fibers have equal nonlinear refractive indices, then the difference between the first and second nonlinearities exceeds 20 % of the second nonlinearity.

As to claim 116, the first and second fibers have different dispersions.

As to claim 117, the coupler **12** splits the incoming optical signal into two counterpropagating portions. As to claim 122, the coupler **12** provides equal coupling in both directions since it is a 3 dB coupler (50-50 split).

As to claim 123, the fiber loop includes a polarization controller **28**.

As to claim 124, a lossy element **37** may be coupled to the loop as shown in fig. 3.

Regarding claims 128 and 129, the amplifier 18 is preferably an erbium doped fiber amplifier. As to claim 130, Lichtman states that other types of amplifiers may be used (col. 4 lines 2-4), thus it is asserted that Raman amplifiers are within the scope of Lichtman's invention.

As to claim 135, Lichtman teaches that the amplifier may provide a gain as high as 28 dB (col. 4 lines 20-22).

As to claim 136, the first fiber 16 has an exemplary length of 6.9 km.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 198, 201-204, 209-211, 213, 215-217, and 222-224 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lichtman et al. (cited above).

Lichtman discloses the recited elements of the first loop mirror of claim 198, but does not disclose an additional input optical fiber and a splitter coupled to the input fiber for separating adjacent channels of an input optical signal. Optical communication systems using both wavelength division and time division multiplexing simultaneously are known in the art. The Lichtman device operates as a time division demultiplexer for input signals of a given wavelength (e.g. 1556 nm in the exemplary embodiment). It would have been obvious to a person having ordinary skill in the art to use the devices taught by Lichtman as the time division

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demultiplexers in a hybrid WDM/TDM system since they exhibit effective suppression of undesired channels, low polarization dependence, and low sensitivity to environmental influences. Such a hybrid system typically includes an input fiber and a splitter, in particular, a wavelength division demultiplexer, for separating adjacent wavelength channels. The above-proposed combination would have satisfied claim 198.

Claims 201-204, 209-211, 213, 215-217, and 222-223 are satisfied by the loop mirror of the Lichtman device as described earlier. As to claim 224, the splitter **12** also acts as a combiner, and an output fiber **14** is coupled to it.

Allowable Subject Matter

Claims 1-19, 21-54, 63-110, 137, 158, and 179 are allowed. Claims 20, 55, 60-62, 138-157, 159-178, and 180-197 will be allowed in turn, pending suitable amendments to overcome the above objections.

Claims 112-113, 118-119, 121, 125, 127, 131-134, 199-200, 205-208, 212, 214, and 218-221 are objected to as being dependent upon rejected base claims, but would be allowable if rewritten in independent form including all of the limitations of the base claims and any intervening claims (and if claims 118, 199-200, 205-208, 212, 214, and 218-221 are suitably amended to overcome the above objections).

Claims 56-59 and 120 would be allowable if rewritten to overcome the rejections under 35 U.S.C. 112, second paragraph, set forth in this office action and to include all of the

limitations of the base claim and any intervening claims (and if claims 56-59 are amended to overcome the above objections).

Independent claims 1, 21, 41, 73, 137, and 158 each require at least a portion of the fiber loop mirror to have a dispersion of at least 20 ps/nm/km in magnitude. None of the references of record discloses or suggests a loop mirror having a fiber portion which satisfies this limitation. For example, several of the references disclosing asymmetrical fiber loops include a standard single mode fiber, which has a dispersion of only about 17 ps/nm/km, and a dispersion shifted fiber, which has a dispersion of only nearly zero ps/nm/km. None of the references provides any suggestion or motivation for specifically choosing a fiber with higher dispersion.

Independent claim 52 similarly requires a portion of the fiber loop to have a “sufficiently large dispersion to minimize phase shift interactions between adjacent wavelength signals”. Applicant states that phase shift interactions can be minimized by providing the various fibers with a length which exceeds their respective walk-off length (p. 15 lines 3-8; p. 16 lines 10-24; p. 29 lines 8-19, etc.). The closest reference in this regard is an article by Tamura et al. in Photonics Technology Letters (February 1999, cited on the attached PTO-892). Tamura discloses a nonlinear optical loop mirror having two different types of fibers in the loop. Using applicant’s definition of the walk-off length, given the closest data points in fig. 4 (at about 70 mW of input power, $\Delta\tau$ is about 0.15 ps and $\Delta\lambda$ is about 15 nm), and D for the SMF of about 17.3 ps/nm/km, then the walk-off length is about 1.15 m for the SMF for that particular input power. However, Tamura uses a length of only 1 m for the SMF. Tamura does not discuss or suggest any need for a greater length of SMF than what was used. In summary, none of the cited references teaches or suggests a NOLM which meets all the requirements of claim 52.

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Independent claim 54 recites a regeneration system including a demultiplexer, a multiplexer, and a plurality of NOLMs, wherein each NOLM has nearly the same limitations as the one recited by claim 111. Although the Lichtman et al. reference was applied above to claim 111, there is no motivation or teaching in Lichtman that would lead a skilled person to use a group of the Lichtman NOLMs in the overall regeneration system set forth in claim 54. None of the other references of record teaches or suggests the complete combination of features recited by claim 54.

Independent claims 93 and 179 recite an optical loop mirror having a pair of fibers with different effective nonlinearities, wherein one of the fibers has a length which exceeds the walk-off length for adjacent wavelength signals in that fiber. Tamura et al. is again deemed to be the closest reference to these claims. However, as discussed above, neither fiber in the Tamura loop mirror has a length which exceeds its respective walk-off length, and Tamura provides no suggestion to meet this condition. The other references of record similarly fail to disclose or suggest a NOLM which meets all the requirements of claims 93 and 179.

Claims 112-113, 118-119, 121, 125, 127, 131-134, 199-200, 205-208, 212, 214, and 218-221 depend from rejected independent claims 111 and 198. As to claims 112-113 and 199-200, none of the cited references discloses or suggests a NOLM having two distinct fibers wherein at least one of the fibers has a length exceeding its respective walk-off length as discussed above. As to claims 118-119, 121, and 205-208, none of the cited references discloses or suggests using a fiber having a dispersion of at least 20 ps/nm/km in magnitude in a NOLM, as also discussed above.

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As to claims 125 and 212, the applied Lichtman et al. reference does not disclose or suggest using the recited devices as lossy elements. As to claims 127 and 214, Lichtman does not disclose or suggest placing the bidirectional amplifier at the midpoint of the loop. As to claims 131-132 and 218-219, the lengths of the fibers in the Lichtman NOLM are not longer than the walk-off length, as discussed above. Since the walk-off length depends on the dispersion, the fibers in Lichtman are consequently seen to have insufficient dispersion to minimize the phase shift interactions. As to claims 133-134 and 220-221, Lichtman does not describe or suggest any dispersion compensation function achieved by the NOLM. None of the other references of record satisfies all the limitations of the parent claims of claims 125, 127, 131-134, and 212, 214, 218-221.

Conclusion

The following references are considered pertinent to applicant's disclosure, and are cited on the attached PTO-892 form: US 5625727, US 5655039, US 6377391, US 6424773, US 2003/0012492, M.E. Fermann et al. (Optics Letters July 1990), M. Matsumoto et al. (Electronics Letters May 1998), Y.J. Chai et al. (Electronics Letters, August 2000), and N. Chi et al. (Photonics Technology Letters, November 2002).

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Any inquiry concerning this communication should be directed to Mike Stahl at (703) 305-1520. Official communications eligible for submission by facsimile may be faxed to (703) 308-7724 or (703) 308-7722. Inquiries of a general or clerical nature (e.g., a request for a missing form or paper, etc.) should be directed to the Technology Center 2800 receptionist at (703) 308-0956 or to the technical support staff supervisor at (703) 308-3072.

MJS

Michael J. Stahl
Patent Examiner
Art Unit 2874

11 June 2003



HEMANG SANGHAVI
PRIMARY EXAMINER